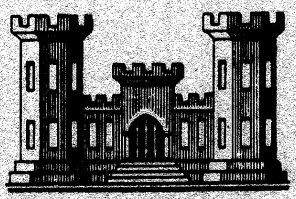
MAJOR REHABILITATION PROJECT
SAGAMORE HIGHWAY BRIDGE
CAPE COD CANAL
BOURNE, MASSACHUSETTS

RECONNAISSANCE REPORT



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JULY 1977

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-E

3 August 1977

SUBJECT: Reconnaissance Report, Major Rehabilitation Project, Sagamore Highway Bridge, Cape Cod Canal, Bourne, Massachusetts

HQDA (DAEN-CWO-M)
WASH DC 20314

1. In accordance with ER-1130-2-417, there is submitted for review and approval a Reconnaissance Report, Major Rehabilitation Project, Sagamore Bridge, Cape Cod Canal, Bourne, Massachusetts.

2. The New England Division is prepared to complete a detailed design memorandum for the project. The project schedule contained in the report outlines the time and funds required to complete the design memorandum and supplementary environmental impact statement.

3. The delay in implementation of the proposed rehabilitation project as shown in the Project Schedule (Fig. 5) is required by the need to complete a similar project at the Bourne Highway Bridge before starting on the Sagamore Bridge. It is not possible to close or partially close both bridges simultaneously.

4. The Reconnaissance Report for the Bourne Bridge is being prepared and is expected to be presented in early September.

5. It is requested that approval be granted to prepare a design memorandum and supplementary environmental impact statement for the subject project. E.I.S. for Cape Cod Canal was filed 8 July 1977.

FOR THE DIVISION ENGINEER:

Joe B. Fryar

Incl (10 cys)
as

JOE B. FRYAR
Chief, Engineering Division

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

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SAGAMORE HIGHWAY BRIDGE
BOURNE, MASSACHUSETTS

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LIST OF TABLES

1. Purpose. The purpose of this report is to present the findings of an investigation of significant maintenance work required at the Sagamore Highway Bridge, Cape Cod Canal and to establish the appropriateness of funding the proposed work under the Construction, General, Major Rehabilitation Program.

2. Scope of Report. This report has been prepared in accordance with the guidelines set forth in ER 1130-2-417. All of the conditions necessary for consideration for funding under Construction, General, Major Rehabilitation Program are present. The report will establish this in addition to outlining funding, design and design review requirements for the project should it be adopted.

3. Project Authorization. The Cape Cod Canal was originally constructed by private interests chartered by the Massachusetts Legislature. The original Canal was completed to a bottom width of 100 feet and a depth of 25 feet in 1916. The United States Government purchased the Canal in 1928 at a cost of $11,500,000 and placed it under the supervision of the United States Army, Corps of Engineers. The Canal was ultimately widened to a minimum bottom width of 480 feet and a depth of 32 feet as authorized by the National Industrial Recovery Act of 1933. In August of 1933 the War Department authorized $4,600,000 for the construction of three bridges to cross the widened Canal. The authorization called for the construction of two highway bridges and one railroad bridge. The highway bridges, known as the Bourne and Sagamore Bridges, were opened to traffic in 1935. The Sagamore Highway Bridge is the feature of the Cape Cod Canal which is the subject of this report.

4. Project Description. The Sagamore Bridge traverses the canal in the town of Bourne, Massachusetts connecting State Highway Route 3 on the mainland with State Highway Route 6 on Cape Cod. The Cape became an island with construction of the canal and the Sagamore Bridge provides one of the two crossings for motorists and pedestrians traveling to and from the Cape. The bridge is located approximately two miles from the eastern entrance to the canal at Cape Cod Bay as shown on the Location Plan, Figure 1. The bridge carries four ten foot wide traffic lanes plus a sidewalk and provides a minimum vertical clearance of 135 feet over a horizontal distance of 480 feet for shipping using the canal. The main support of the structure consists of two three span continuous trusses supported by concrete abutments and two concrete channel piers. The approach spans are 396 feet long and the center span across the canal is 616 feet long. The trusses in the center span are arched, reaching a height of 120 feet above the roadway, with the roadway suspended by wire rope hangers. Figure 2 is a photograph of the bridge and Figure 3 is a key plan identifying major features of the bridge. In addition to its highway function the bridge carries telephone lines and a pipeline supplying natural gas to the Cape. No major modifications have been made to the structure since its construction.

5. Current Condition. An in-depth inspection of the bridge superstructure was conducted during 1975 and 1976. The results of that inspection and related investigations are presented in the report "Sagamore Highway Bridge, 1976 Condition Report" filed with the Chief of Engineers on 18 April 1977. It constitutes the basis for the current conditions and recommendations described in this report. The current condition of the various components of the bridge are discussed in the following paragraphs:

a. Abutments and Piers. The abutments and piers are in good condition with no serious cracking or spalling. An evaluation of foundation stability was made as part of the 1969 condition report and it was concluded that the foundations of the substructure components are stable. Horizontal and vertical survey controls have been established for the abutments and piers and are checked at regular intervals. Surveys indicate that the conclusions reached in 1969 regarding foundation stability are still valid.

b. Truss Bearings. Truss bearings are in good condition and are functioning properly. Anchor bolts at the abutment bearings are bent to some degree.

c. Truss Members and Connections. The members making up the trusses are in good condition structurally. A number of lacings and stay plates require replacement. Truss connections are in good condition mainly requiring the replacement of some rivets whose heads have deteriorated beyond an acceptable level.

d. Truss Bracing Members and Connections. The upper and lower lateral and sway bracing systems for the trusses are in good condition except for numerous lacings, stay plates, rivets and some horizontal connection plates which are in need of replacement. In addition, the ends of some members need reinforcement where they have been affected by the deterioration at the horizontal gusset plates.

e. Cable Hangers. The cable hangers which support the suspended roadway of the main span were the subject of intensive investigation and testing. The pairs of cables at panel points 14'W and 15 E (See Figure 3) were removed and replaced with new cables. The removed cables were subjected to physical and metallurgical testing to determine their strength and probable remaining life. The results of the investigations are contained in a report titled; "Sagamore and Bourne Highway Bridges-Suspender Cables-1976 Condition Report." In summary, the conclusions of that report state that the tested cables still possess the originally specified strength and that the galvanized coating has started to break down. The report further states that it will be 10 to 15 years before extensive corrosion may be expected to occur. Continued regular inspection is recommended in order to detect accelerating corrosion and certain maintenance procedures are outlined. Eventual replacement of the cables is foreseen as no known maintenance program will arrest the deterioration of the galvanized coating at critical locations. The remaining useful life of the cables places them beyond the time frame of projected repairs as recommended in the ER (5 years) and their replacement has not been included in the proposed Rehabilitation Project.

f. Roadway Supporting Steel. The floorbeams which are spaced at 44 feet are generally in good condition. Most of the corrosion on these members consists of deteriorated rivet heads near the ends and deterioration of the top flange beneath the sidewalk. The brackets which support the sidewalk channels at the floorbeams located at the ends of the suspended span are in poor condition and require repair. There are nine lines of stringers supporting the roadway. They are speced at 5 feet and span the 44 feet between floorbeams. Typical corrosion at the stringers is on the top of the bottom flange of the outside roadway stringers. This corrosion was the result of water leaking through the roadway at the gutter lines and sidewalk.

g. Suspended Floor Bracing. The bracing for the suspended floor consists of longitudinal wind chords each side of the deck connected to the floorbeams and diagonals. The major corrosion associated with this bracing system is that occurring on the diagonals where the catwalk grating rests upon them. The diagonals must be reinforced where significant loss of metal has occurred.

h. Sidewalk Supporting Steel. The channels supporting the sidewalk are generally in good condition except for deterioration at the clip angles which support them at the top of the floorbeams. Corrosion is also common at bracing angles and connecting gussets of the sidewalk bracing.

i. Deck Concrete. Condition of the deck concrete was determined by visual inspection of the underside of the deck and by tests made on six 4-inch diameter cores taken from the deck. The deck between the exterior stringer and the first interior stringer on each side of the bridge was rebuilt during the 1962 renovations. Buckle plate construction was used in these areas and the underside of the concrete could not be visually inspected. The bituminous concrete wearing course precluded inspection of the top surface of the deck concrete. The underdeck inspection revealed numerous areas of spalled concrete and exposed reinforcing steel. The typical areas of spalled concrete occurred along the top flanges of stringers and floorbeams, between stringers and at areas where patching has been done previously. It is estimated that 5 percent of the area of underdeck concrete is spalled. The deck concrete, except for the portion replaced in 1962, was constructed with lightweight (Haydite) aggregate. The core samples indicate extensive honeycombing of this concrete and deterioration of the reinforcing steel in it. One core exhibited excessively high chloride content. The following paragraph is contained in the report on core sample investigations by the Construction Technology Laboratories of the Portland Cement Association and summarizes their conclusions on the existing deck concrete:

> "In terms of materials and type of application, the Haydite concrete is obviously inadequate due to lack of consolidation, greatly facilitating cyclic freeze-thaw damage and paste deterioration via deicer chemicals. Petrographic observations of the paste revealing microcracks, some open or partially filled with ettringite suggest continuing deterioration."

It is concluded that the concrete deck is in poor condition and in need of complete replacement.

j. Bituminous Concrete Wearing Course. The 2-1/4-inch bituminous pavement on the roadway was replaced as part of renovations made in FY 1962. There are numberous cracks in the pavement and some unraveling adjacent to the east curb.

k. Painting System. The original painting system protecting the structural steel consists of two coats of red lead and linseed oil and a finish coat of white lead and linseed oil. Subsequent repaintings have been made with a ready mixed paint consisting of aluminum paint, tung oil and phenolic varnish. Steel beneath roadway joints has been coated with a coal tar epoxy. The painting system currently is in poor condition. Flaking, blistering and surface rust is evident to some degree on all members. The problem is especially evident on horizontal connection plates and at areas where water is leaking through the roadway. Improper cleaning prior to repainting is a serious cause of continued deterioration. Much of the steel work consists of built up members with numerous lacing bars, rivets and connection plates. This type of steel construction is very difficult, if not impossible to clean by ordinary methods. Certain areas of the steel, such as insides of truss members, are difficult to reach and have not received adequate attention during repainting. It is recommended that the steel be completely cleaned of existing paint by blast methods and that a new vinyl system be applied.

l. Miscellaneous Items. The following is a listing of miscellaneous bridge components together with an assessment of their general condition:

Catwalk - Limited areas of deteriorated support angles and gratings.
Railings - In good condition.
Light Standards - Some rivets, bolts and lacings deteriorated.
Roadway Expansion Joints - In good condition, having been rebuilt in FY 1974.

6. Recommended Repairs. Table No. 1 is a tabulation of bridge components currently in need of repair including items which would need to be repaired during the next 5 years and their associated costs. A contingency item has been included in the cost of repairs due to the probability that the need for additional steel repair work will be apparent in areas which were not accessible for inspection prior to the removal of deck concrete. Project costs have been separated to show the costs attendant to each of the three project phases; design memorandum, plans and specifications and construction.

7. Replacement Costs. Replacement cost of the bridge superstructure is estimated to be $19,000,000 and replacement of the substructure is estimated at $8,000,000 for a total replacement cost of $27,000,000. The estimated cost (October 1977) of recommended repairs to the bridge superstructure is approximately 26% of the superstructure replacement cost or 18% of the total replacement value of the bridge. The replacement cost estimates assume the same geometric parameters as the original construction but not necessarily the same structural system.

TABLE 1

SAGAMORE HIGHWAY BRIDGE - MAJOR REHABILITATION PROJECT

PROJECT COSTS

PROJECT PHASE	ESTIMATED COST* Operations Maintenance Funded	Major Rehabilitation Program
Design Phase		
Preparation of Reconnaissance Report	$ 10,000	
Preparation of Design Memorandum	100,000	
Preparation of Supplement to E.I.S.	25,000	
Preparation of Plans and Specifications		$ 150,000
Sub Total	$ 135,000	$ 150,000
Construction Phase		
Repairs to Structural Steel		735,000
Contingent Steel Repairs		147,000
Remove and Replace Concrete Deck		2,890,000
Remove Existing Paint and Repaint		565,000
Supervision and Inspection		270,000
Sub Total	--	$ 4,607,000
FUNDING TOTALS	$ 135,000	$ 4,757,000
TOTAL PROJECT COST	$ 4,892,000	

*October 1977 Price Levels

8. History of Maintenance and Rehabilitation. Table 2 presents a chronology and costs of maintenance work contracted during the life of the project. Not included are costs of periodic inspections and maintenance performed by government personnel, administrative costs or fees of consultants retained to perform inspections and prepare condition evaluation reports. Major renovations were made to the bridge in 1962. At that time a 5-foot width of deck adjacent to each curb was replaced for the entire length of the bridge, the bituminous concrete wearing course was removed, the roadway waterproofed and repaved, new granite curbing installed and spalled areas of the deck concrete were patched.

9. Project Use. The Sagamore Bridge is a link in a heavily traveled highway route. Approximately 8,500,000 vehicles currently cross the bridge each year. The number of vehicles has increased substantially since the bridge was constructed and is projected to continue to increase in the future. The roadway provides four 10-foot wide traffic lanes, two in each direction, with no provision for shoulders or breakdown lanes. The average daily traffic during July and August is approximately two times the average daily traffic for the year. Numerous delays occur during peak travel hours due to vehicles breaking down on the bridge. The substandard lane widths, lack of shoulders, steep vertical grade and roadway circle at the north approach impede the flow of traffic even when there are no obstructions on the bridge. Repairs to the structure must be scheduled during off peak periods which restricts the useable construction season to a maximum of three months either in the spring or fall. Even during off peak seasons the weekend traffic is heavy and long delays result if any lanes are closed. Eventually traffic volume will necessitate an additional bridge across the canal. Until such time, the Sagamore Bridge will continue to perform its function within its geometric limitations. The proposed Rehabiliitation Program will ensure its ability to do so with normal maintenance for an estimated 40 years in the future. It is most probable that the impetus for a new or additional bridge will materialize within this time and that the existing bridge purpose will have been served or its subsequent use somewhat diminished.

10. Consequences of Not Accomplishing Needed Repairs. If the Rehabilitiation Program is not undertaken, the useful life of the structure can be extended over the short run by performing limited repairs until the time, perhaps 5 years hence, when the rate of deterioration of the deck slab and structural steel would cause a frequency of repair and interruption of traffic that would render the Bridge virtually unusable. The consequences of continual repair work, other than higher ultimate costs, would be the great inconvenience to the traveling public, commuter transportation, school buses and emergency vehicles which would result. Under a major rehabilitiation project, work can be scheduled into a compressed time frame and adequate planning made for alleviating the inconveniences during construction.

TABLE 2

SAGAMORE HIGHWAY BRIDGE

CHRONOLOGY OF EXPENDITURES FOR MAINTENANCE AND REHABILITATION

FISCAL YEAR	CONTRACT TITLE	DESCRIPTION OF WORK	COST
1938	PAINTING	PAINT SUPERSTRUCTURE	$ 8,000
1938	PAVING	SEAL COAT - SHEET ASPHALT	5,149
1942	PAINTING	PAINT RAILINGS	4,314
1947	PAINTING	PAINT SUPERSTRUCTURE	18,000
1952	PAINTING	PAINT SUPERSTRUCTURE	36,000
1955	PAVING	REPLACE BITUMINOUS PAVEMENT	22,985
1959	REPAIRS TO BOURNE AND SAGAMORE BRIDGES	REPLACE ROLLER NEST WEST TRUSS BEARING AT NORTH ABUTMENT	4,000
1962	RENOVATION OF SAGAMORE HIGHWAY BRIDGE	RESURFACE ROADWAY AND SIDEWALK, INSTALL NEW CURBING, REPAIR EXPANSION JOINTS, REPLACE 5-FOOT STRIPS OF DECK CONCRETE ADJACENT TO CURBS, ELECTRICAL WORK, NEW ROADWAY SCUPPERS, REPAIRS TO CONCRETE	560,747
1963	PAINTING	PAINT SUPERSTRUCTURE	35,090
1963	BOURNE AND SAGAMORE HIGHWAY BRIDGES MAJOR REHABILITATION-STRUCTURAL	ADD ACCESS LADDERS AND PLATFORMS, SCUPPER DOWNSPOUTS, REPAIR UNDERDECK CATWALK, REPLACE RAILING BOLTS	80,000
1969	SAGAMORE AND BOURNE HIGHWAY BRIDGES STRUCTURAL REPAIRS	REHABILITATION OF SIDEWALK AND CURB, REPAIR CRACKS IN SUBSTRUCTURE	90,000
1969	PAINTING	PAINT SUPERSTRUCTURE	154,200
1974	SAGAMORE BRIDGE RENOVATION	REPAIR STRUCTURAL MEMBERS, CONCRETE, EXPANSION JOINTS, RAILINGS AND MISCELLANEOUS WORK	679,308

TABLE 2

SAGAMORE HIGHWAY BRIDGE (CONT'D)

FISCAL YEAR	CONTRACT TITLE	DESCRIPTION OF WORK	COST
1976	REMOVAL OF BIRD EXCREMENT FROM ABUTMENTS	--	$ 6,835
1976	HANGER CABLE REPLACEMENT	REMOVE 2 PAIRS OF CABLES FOR TESTING AND REPLACE WITH NEW CABLES	146,370
1977	ALTERATION OF EXPANSION JOINT	INSTALL HOLD DOWN DEVICE AT SOUTH ABUTMENT EXPANSION JOINT	4,824

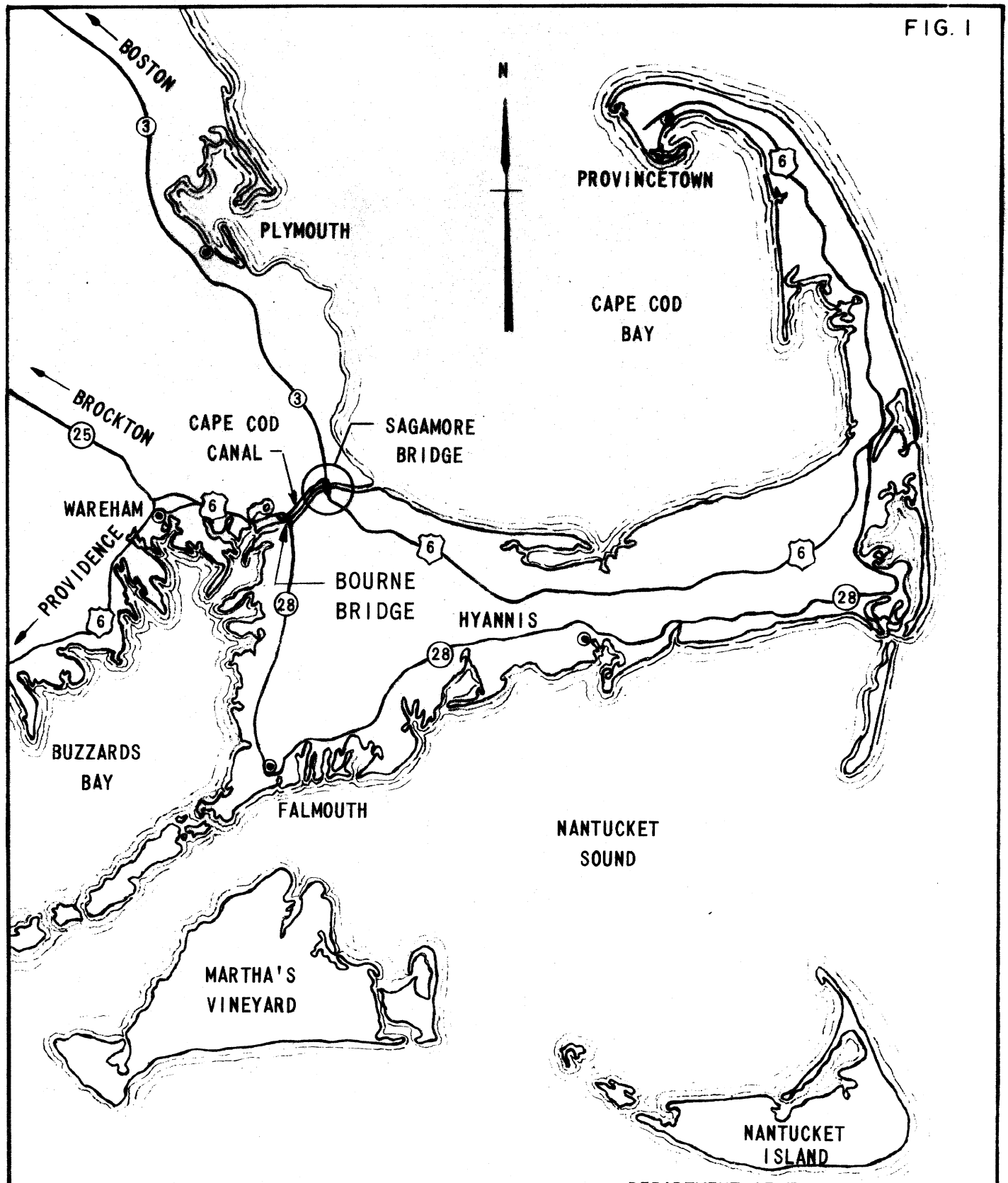
11. Schedule of Recommended Repairs. It is recommended that all of the repairs necessary to restore the Sagamore Bridge as outlined in Table 1 be funded under a Construction, General, Major Rehabilitation Program and that Construction be accomplished during fiscal years 1982 and 1983 as shown in Figure 5. The delay indicated by this schedule is necessary so that anticipated repairs at the Bourne Bridge will be completed before starting work on the Sagamore Bridge.

12. Alternatives to Recommended Work. There are three alternatives to the recommended rehabilitation program. First is the do nothing alternative which if adopted would render the structure unsafe for use, perhaps within 5 years, at which time it would cease to fulfill its purpose. The second alternative would be to perform continuing costly maintenance under operations and maintenance funding which would extend the useful life over the short run at a high cost with great inconvenience to the users of the bridge as outlined in paragraph 10. The third alternative would be to construct a new replacement bridge with geometric standards which would better serve the project purpose. The first alternative is not feasible from a project function viewpoint and the second is not feasible economically or environmentally. The third or new bridge alternative is not economically feasible considering the cost including approach roadways.

13. Environmental Considerations. The major impacts of the rehabilitation program, if adopted, will result from the closing of the bridge to traffic for a period of up to eight months during the removal and replacement of the concrete deck slab. All traffic including local and through traffic, using State Highways 3 and 6 will be required to travel to the Bourne Bridge, some 3 miles to the West, to cross the canal, a detour of approximately 7 miles. This will result in delays to travelers, lengthening of commuter bus runs and will require planning routes for emergency vehicles and school buses. These and other impacts such as disposal of the removed deck concrete and environmental effects of blast removal of the existing paint system will be addressed in a supplement to an Environmental Impact Statement currently on file. The statement on file assesses the impacts of operation and maintenance of the Cape Cod Canal. The proposed schedule for preparation and filing of the supplement is shown in Figure 5.

14. Schedule of Design. A proposed schedule for preparation of design reports, Environmental Impact Statement supplement, plans and specifications is shown in Figure 5. The review and approval level recommended for each phase of the project is also indicated in Figure 5.

FIG. 1



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

CAPE COD CANAL
BOURNE, MASS.

SAGAMORE HIGHWAY BRIDGE
MAJOR REHABILITATION PROJECT
RECONNAISSANCE REPORT
LOCATION PLAN

VL-56
C-1

FIG. 2

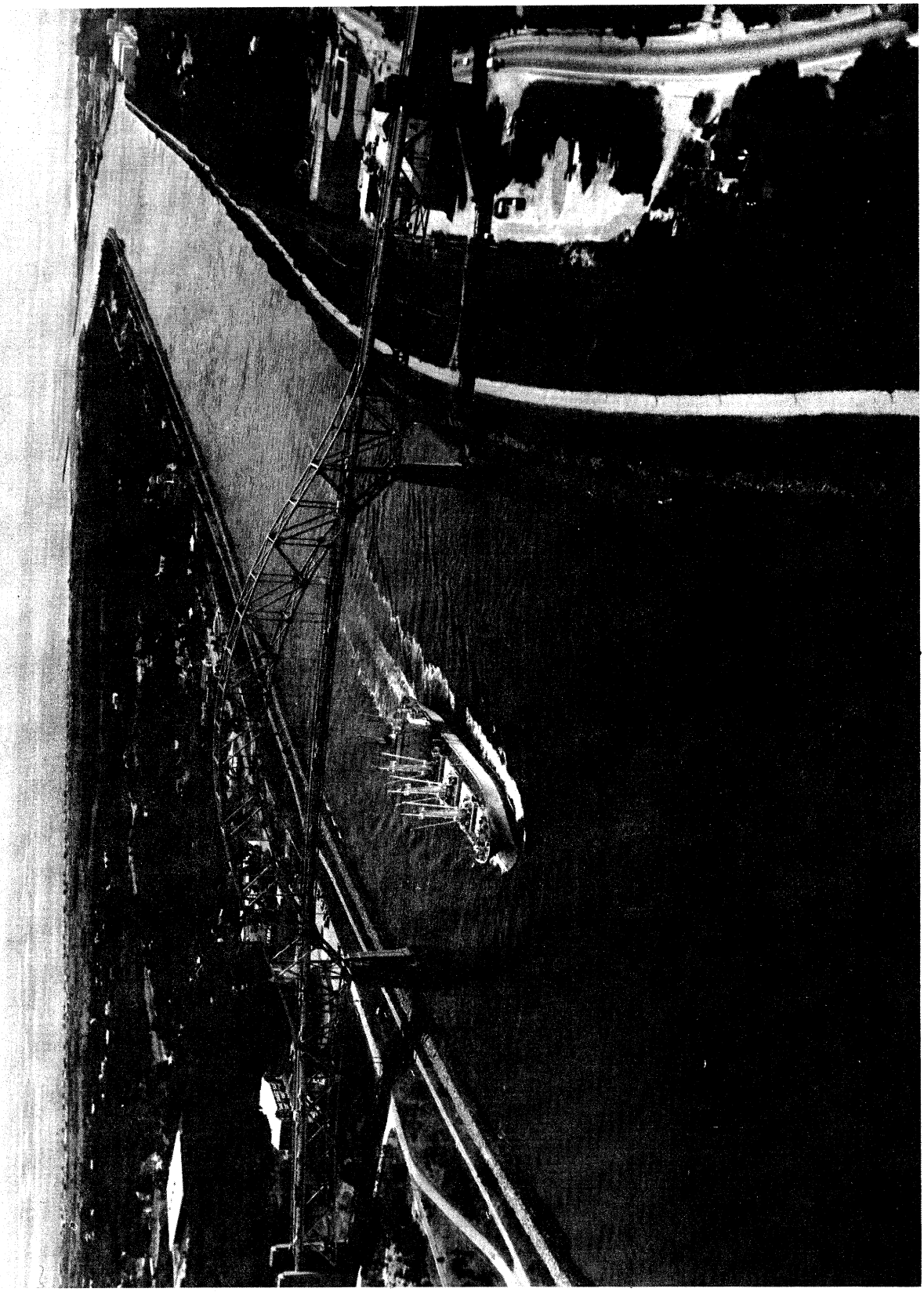


FIG. 3

SWAY BRACING SOUTH END

PANEL 0 | PANEL 5 | PANELS 6, 7 & 8 | PANEL 9 | PANEL 10

SWAY BRACING NORTH END

PANEL 10' | PANEL 9' | PANELS 6', 7' & 8' | PANEL 5' | PANEL 0'

PLAN - SUSPENDED FLOOR BRACING

F.B.10 — F.B.10'

PLAN - TOP CHORD BRACING

WU_0 — WU_9 — $WU_{9'}$ — $WU_{0'}$

F.B. — F.B.

EU_0 — EU_9 — $EU_{9'}$ — $EU_{0'}$

WL_0 — WL_9 — $WL_{9'}$ — $WL_{0'}$

N

PLAN - LOWER CHORD BRACING

EL_0 — EL_9 — $EL_{9'}$ — $EL_{0'}$

℄ CABLES — ℄ CABLES

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19

51' - ℄ TO ℄ OF HANGERS

SECTION A-A

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 15' 14' 13' 12' 11' 10' 9' 8' 7' 6' 5' 4' 3' 2' 1' 0'

A — A

44' TYP.

EXP. | SPAN 3 | EXP. | SPAN 1 | FIXED | SPAN 2 | EXP.

Roadway | RR | Roadway | M.L.W.= ELEV. 96.3 | Roadway

SOUTH ABUTMENT
CAPE SIDE

PIER 1 | PIER 2

NORTH ABUTMENT
MAINLAND

225' | 396' | 616' | 396' | 200'

1408'

1833'

ELEVATION

50 0 100 200

SCALE IN FEET

LEGEND

E = EAST
W = WEST
F.B.= FLOOR BEAM
L = LOWER CHORD PANEL POINT
U = UPPER CHORD PANEL POINT
MLW = MEAN LOW WATER BASED ON MSL=100

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SAGAMORE HIGHWAY BRIDGE
MAJOR REHABILITATION PROJECT
RECONNAISSANCE REPORT
KEY PLAN

FIG. 4

REINFORCING TRUSSES
Spaced 6'-0" c. to c. Depth 5'-0" out to out of truss and cambered as shown. Top and bottom chord areas each chord = 0.44 sq. in. web area to average 1" per lin. ft. of truss

SECTION A-A
Continuous flat steel supports at all stringers.

Cover Plates - Top & bottom flanges.

51'-0" ℄ to ℄ of Hangers

Web Pl. 60"x1/2" - 4 lb 8"x8"x1" - 2 Cov. Pl. 18"x1" - 33'-0" long - Spans 1.2.3.
" " 60"x1/2" - 4 lb 8"x8"x1" - 2 " " 18"x1" - 28'-0" " " " 5
" " 60"x1/2" - 4 lb 8"x8"x1" - 2 " " 18"x1" - " " " " 4.7
" " 60"x1/2" - 4 lb 8"x8"x1" - " " " " " " 6
Flange Ls & Cover Pls. Silicon Steel.
Web Pls. Carbon Steel.
All Floor Beams 60 1/2" b-b of Angles.

27"C.B 97# Spans 1,2,3. Silicon Steel.
27"C.B 85# " 4,7. Carbon "
24"C.B 81# " 6. " "
27"C.B 97# " 5 " "

CROSS SECTION OF ROADWAY - SPAN 1
(Except as noted)

Existing haydite concrete deck (typ.)

CROSS SECTION OF ROADWAY - SPANS 4 & 7 AS SHOWN - SPANS 1,2,3,5 & 6 AS NOTED

Intermediate Stiffener 4s. Extend Full Depth No Seat 4s. at Bottom of Stringers

Traffic Marker - see Detail.

4-3" Diam. Holes.

Waterproofing under Bituminous surface to be carried to this point on both sides of Roadway all spans.

Bituminous Surface

51'-0" c. to c. of Trusses

DETAIL OF TRAFFIC MARKER
SCALE 1 0 1 2 FT

SECTION SPANS 2 & 3

SECTION SPAN 6

SECTION B-B

SECTION E-E

SECTION C-C

DETAIL OF CHANNEL CONNECTION TO FLOOR BEAM

DETAIL AT INTERMEDIATE FENCE POST

DETAIL OF PULL BOX

DETAIL OF WALKWAY (included for payment with structural steel)

FENCE DETAILS
SCALE 1" 1 FT

ELEVATION
INTERMEDIATE FENCE POST

TYPICAL DETAIL AT HANGER

SPACING SCHEDULE FENCE POSTS

Span	No. of Spaces per Panel	Distance between Posts c. to c.
7	4	7'-6"
5	5	6'-9"
3	6	7'-6"
1	6	7'-6"
2	6	7'-6"
4	4	7'-6"
6	4	6'-6"

Legend:
Concrete in Section shown thus:
Reinforcing steel in section shown thus:
Reinforcing Truss web shown thus:

Notes:
For Spans 1, 2 and 3 see Sheets No. 6-11 inclusive.
For Spans 4, 5, 6 and 7 see Sheets No. 12-15 inclusive.
For details of expansion joints see Sheet No. 5
Bottom of concrete slab to be flush with bottom of top flange of stringers.
All steel to be Carbon unless otherwise noted.
For detail of scuppers see Sheet No. 5
For detail of Lamp post see Sheet No. 10
Rivets to be 7/8" ℄ - Oper. holes to be 15/16" ℄ (Holes 1 1/16" in ft. Bm.)
For Section D-D see Sheet No. 5 End Conn. 4s
All fence posts to be vertical.

NOTE:
ONLY SPANS 1, 2, AND 3 ARE APPLICABLE TO SAGAMORE BRIDGE. PLAN REVISED TO SHOW CONDITION AT TIME OF INSPECTION, AUG. 1969

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
DECK SECTIONS
SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY

CRAM & FERGUSON, CONSULTING ARCHITECTS
BY

APPROVED
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 4 OF (17)

VL-51
C-3

SAGAMORE HIGHWAY BRIDGE – MAJOR REHABILITATION PROJECT

PROJECT SCHEDULE

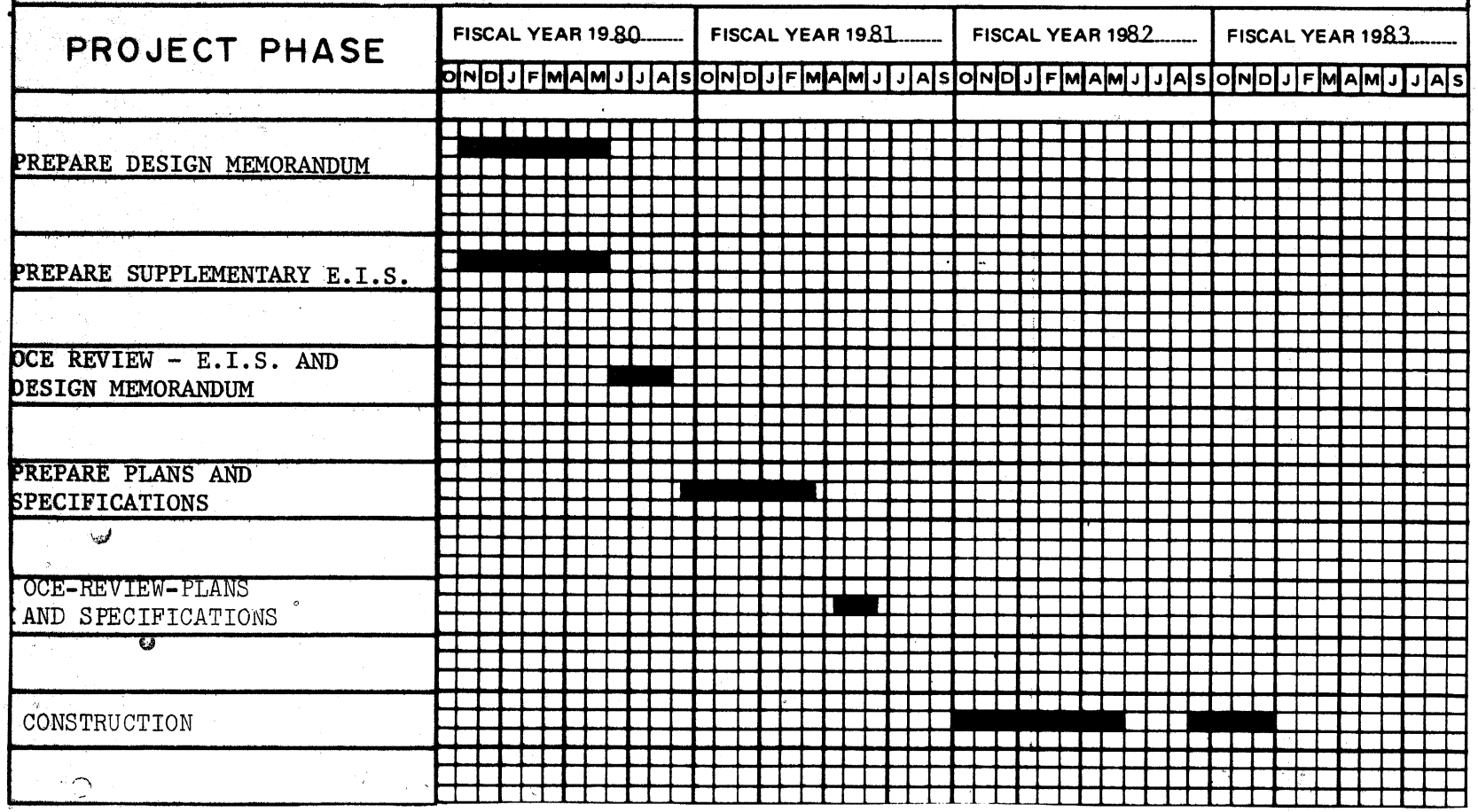

FIGURE 5